

October 7, 2021

U.S. Fish and Wildlife Service
MS: PRB/3W
5275 Leesburg Pike
Falls Church, VA 22041-3803

Attention: Louise Clemency, Chicago Ecological Services Field Office

Re: American Bumble Bee
Docket No. FWS-R3-ES-2021-0063

THREAT TO THE AMERICAN BUMBLE BEE FROM RF RADIATION

In response to a petition from the Center for Biological Diversity, the Fish and Wildlife Service published a Notification of Status Review on September 29, 2021 in the Federal Register. The Service proposes to list the American bumble bee as a threatened or endangered species and requests comments and new information concerning threats to the existence of that species. In its Notification, FWS lists four threats that to the American bumble bee that it has identified: habitat destruction, loss of genetic diversity, climate change, and competition from nonnative honeybees.

I submit the following information regarding a fifth threat to this species: radio frequency (RF) radiation. RF radiation is a threat to both honeybees and bumble bees and is a greater and more urgent threat to the American bumble bee than any of four threats the Service has listed. This pollutant has been responsible for reducing both domestic and wild bee populations for more than a century. This threat to bees has intensified since the beginning of the wireless revolution in 1996, with the construction of hundreds of thousands of cell towers and antennas in all areas of the United States including farmland, forest land, parkland, and nature preserves. It has become an emergency in the past two years with the national rollout of 5G technology, which is multiplying the density of antennas tenfold and more, as well as increasing the frequency, bandwidth, and effective radiated power from each antenna. Cell towers are already exposing the entire world to levels of RF radiation that are up to ten million times stronger than the natural radiation that comes from the sun and stars.

Mechanisms of Action

RF radiation is a form of electromagnetic energy that is used for communication. It is emitted by radio and TV towers, radar stations, cell towers, cell phones, and all of the other wireless devices that are proliferating in today's world. It interferes with navigation, communication and metabolism in bees. It is the effect on metabolism that is killing bees the quickest and driving them to extinction.

Metabolism

Electronic devices and systems manufactured today must be hardened against electromagnetic interference (EMI) from RF radiation coming from so many sources today. A living organism is also electronic in nature and is also subject to EMI. However, life evolved in the virtual absence of RF radiation and is not hardened against it. This radiation affects biology in many ways, but most critical for bees is the interference with electron transport in the mitochondria of cells. The electron transport chain is which is where the last, energy-producing step in metabolism takes place. It is where electrons generated by the metabolism of the sugars, fats and proteins we eat are transferred to the oxygen we breathe, resulting in the generation of ATP. Interference with metabolism affects bees more than other creatures because bees have such a high metabolic rate. It deprives them of energy by starving them of oxygen.

That this actually happens was proved in 2011. N. Kumar, S. Sangwan and P. Badotra, "Exposure to Cell Phone Radiations Produces Biochemical Changes in Worker Honey Bees." *Toxicology International* 181(a):70-72 (2011). These researchers exposed bees to an ordinary cell phone and sampled their hemolymph. After 10 minutes of exposure to a cell phone, the concentration of total carbohydrates in their hemolymph increased from 1.29 to 1.5 mg/ml. After 20 minutes it increased to 1.73 mg/ml. The glucose content rose from 0.218 to 0.231 to 0.277 mg/ml. Total lipids rose from 2.06 to 3.03 to 4.50 mg/ml. Cholesterol rose from 0.230 to 1.381 to 2.565 mg/ml. Total

protein rose from 0.475 to 0.525 to 0.825 mg/ml. In other words, after just ten minutes of exposure to a cell phone, metabolism of sugars, fats and proteins was severely inhibited.

If bees cannot metabolize their food they cannot fly and they will crawl on the ground and die.

Science

The quickest way to destroy a bee hive, scientists have found, is to place a wireless telephone inside it.

In 2009, VP Sharma and N Kumar placed two cell phones each—one in talk mode and one in listening mode in order to maintain the connection—in two of four hives. They turned them on at 11:00 in the morning for 15 minutes, and again at 3:00 in the afternoon for 15 minutes. They did this twice a week between February and April. As soon as the phones were turned on the bees would become quiet and still. During the course of three months fewer and fewer bees flew in and out of those two hives. The number of eggs laid by the queen declined from 546 to 145 per day. The area under brood declined from 2,866 to 760 square centimeters. Honey stores declined from 3,200 to 400 square centimeters. “At the end of the experiment there was neither honey, nor pollen nor brood nor bees in the colony resulting in complete loss of the colony,” wrote the authors.

The following year Kumar performed the experiment described above in which she demonstrated that electromagnetic fields from a cell phone interfere with cellular metabolism in bees and cause them to become oxygen starved.

Daniel Favre, at the Apiary School of the City of Lausanne, Switzerland, observed that bees exposed to a cell phone would become quiet and still at first, but within 30 minutes they would start to produce loud, high frequency sounds like worker piping, which is usually produced by bees when they are preparing to swarm.

Sainudeen Pattazhy, a professor at Sree Narayana College, placed one cell phone inside each of six bee hives and turned the phone on for just ten minutes, once a day for ten days. While the phone was on, the bees became still. The egg-laying rate of the queen declined from 355 to 100 per day. After ten days no bees were left in any of the hives.

German biologist Ulrich Warnke has published a booklet titled *Bees, Birds and Mankind: Destroying Nature by ‘Electrosmog’*, in which he reviews the science on the effects of electromagnetic pollution on orientation, navigation and communication in birds and in bees. “Animals that depend on the natural electrical, magnetic and electromagnetic fields for their orientation and navigation through earth’s atmosphere are confused by the much stronger and constantly changing artificial fields created by technology and fail to navigate back to their home environments.”

Russian researchers EK Eskov and AM Sapozhnikov found in 1975 that bees generate electromagnetic signals with a modulation frequency between 180 and 250 Hz as they perform their waggle dance, and that hungry bees react to the frequencies by holding their antennae erect.

History

Bees began disappearing at the dawn of the radio age. On the small island lying off England’s southern coast where Guglielmo Marconi sent the world’s first long-distance radio transmission in 1901, the honey bees began to vanish. By 1906, the island, then host to the greatest density of radio transmissions in the world, was almost empty of bees. Thousands, unable to fly, were found crawling and dying on the ground outside their hives. Healthy bees imported from the mainland began dying within a week of arrival. In the following decades, Isle of Wight disease spread along with radio broadcasting to the rest of Great Britain, and to Italy, France, Switzerland, Germany, Brazil, Australia, Canada, South Africa, and the United States. In the 1960s and 1970s its name changed to “disappearing disease.” It became urgent in 1996, when cell towers began to be erected throughout the United States, and became a worldwide emergency by 2006, when it was renamed “colony collapse disorder.” Today not only domestic bees, but also all wild bees are in danger of extinction.

In the winter of 1995-1996, beekeepers lost 45 percent of their hives in Kentucky, 60 percent in Michigan, and 80 percent in Maine. By 1997, 90 percent of all feral honey bee colonies had disappeared nationwide.

Europe's first UMTS network—what is now known as “3G” technology, which greatly expanded the network of cell towers and connected them all to the Internet, enabling the operation of smartphones—went into service in the fall of 2002, just before the disastrous winter during which so many of Europe's honey bees vanished.

Ferdinand Ruzicka, a medical physicist and beekeeper in Austria, wrote an article in *Bienenwelt* (“Bee World”) about this problem in 2003 and published a survey form in *Bienenvater* (“Beekeeper”) requesting to be contacted by beekeepers with antennas near their hives. Ruzicka's colonies had collapsed after telecommunications antennas appeared in a field near his hives. The majority of *Bienenvater* readers who filled out his form similarly observed that their bees had become suddenly aggressive when antennas appeared, had begun to swarm, and that their healthy colonies had vanished for no other reason.

In 2003, Swedish beekeeper Börje Svensson published an article titled “Silent Spring in northern Europe?”

During the winter of 2006-2007, when disappearing disease was renamed “colony collapse disorder,” a team of researchers examined thirteen large apiaries owned by eleven different commercial beekeepers in Florida and California, and could not find any specific nutritional, toxic, or infectious factor that differentiated bees or colonies with and without colony collapse disorder. Tracheal mites were more than three times as prevalent in the healthy colonies as in the decimated colonies. The supposedly devastating *Varroa* mite was not more prevalent in collapsed or collapsing colonies. The only specific observation they were able to make was that colony collapse disorder was location-specific, and that colonies with this disorder tended to cluster together. The colonies in those locations not only died, but tended to be left alone even by the parasites that normally infest dead honey bee colonies.

Simultaneous to the disappearance of honey bees, bumble bees also disappeared. The Franklin bumble bee, formerly prevalent in southwestern Oregon, has not been seen since about 2005. Until the mid-1990s, the western bumble bee was abundant in forests, fields, and urban backyards throughout western North America, from New Mexico to Saskatchewan to Alaska. It has vanished except for small pockets in the Colorado Rockies. The rusty-patched bumble bee has not been seen in New York State since 2004. Once common in 26 states and two Canadian provinces, this bee has disappeared from the eastern United States and Canada and has drastically declined in the American midwest.

And, the FWS's 90-day finding reports that the American bumble bee, formerly the most common species of bumble bee in the United States, has disappeared entirely from 12 states and is in severe decline in the 35 states in which it is still found. The petition from the Center for Biological Diversity reports that this species exists at only 11% of its former abundance, and that its rapid decline began only 20 years ago, in 2002.

Conclusion

The Service has failed to provide any reason why any of the four threats to this species that have been identified so far—habitat destruction, loss of genetic diversity, climate change, and competition from nonnative honey bees—should have suddenly cause the American bumble bee's population to plummet after 2002. RF radiation can provide that reason. 3G cell towers and smartphones were introduced in that year in the United States as well as in Europe. On January 28, 2002, Verizon launched 3G service in Utah; in a corridor from Norfolk, Virginia to Portland, Maine; and in the San Francisco/Silicon Valley area. Sprint launched a nationwide 3G network on August 8, 2002.

The American bumble bee should be listed as an endangered species. This listing should occur as quickly as possible. And the FWS should investigate the urgent threat to this species from RF radiation, in addition to the threats that it has listed in its Notification of Status Review.

References

Anderson, John. 1930. “‘Isle of Wight Disease’ in Bees. I.” *Bee World* 11(4): 37-42.

Dyer, F.C. and J.L. Gould. 1981. “Honeybee orientation: a backup system for cloudy days.” *Science* 214: 1041-1042.

- Eskov, E. K. and A. M. Sapozhnikov. 1976. "Mechanisms of Generation and Perception of Electric Fields by Honeybees. *Biophysik* 21(6): 1097-1102.
- Favre, Daniel. 2011. "Mobile Phone-induced Honeybee Worker Piping." *Apidologie* 42: 270-79.
- Imms, Augustus D. 1907. "Report on a Disease of Bees in the Isle of Wight." *Journal of the Board of Agriculture* 14(3): 129-40.
- Kuhn, J. and H. Stever. 2002. "Auswirkungen hochfrequenter elektromagnetischer Felder auf Bienenvölker." *Deutsches Bienen Journal* 4: 29-22.
- Kumar, Neelima R., Sonika Sangwan, and Pooja Badotra. 2011. "Exposure to Cell Phone Radiations Produces Biochemical Changes in Worker Honey Bees." *Toxicology International* 18(1): 70-72.
- Lindauer, Martin and Herman Martin. 1972. "Magnetic Effect on Dancing Bees." In: Sidney R. Galler, Klaus Schmidt-Koenig, G. J. Jacobs, and Richard E. Belleville, eds., *Animal Orientation and Navigation* (Washington, DC: Government Printing Office), NASA SP-262, pp. 559-67.
- Pattazhy, Sainudeen. 2011. *Impact of Electromagnetic Radiation on the Density of Honeybees: A Case Study*. Saarbrücken, Germany: Lambert Academic.
- Pattazhy, Sainudeen. 2011. "Impact of Mobile Phones on the Density of Honey Bees." *Munis Entomology and Zoology* 6(1): 396-99.
- Pattazhy, Sainudeen. 2012. "Electromagnetic Radiation (EMR) Clashes with Honeybees." *Journal of Entomology and Nematology* 4(10): 1-3.
- Phillips, Ernest F. 1925. "The Status of Isle of Wight Disease in Various Countries." *Journal of Economic Entomology* 18: 391-95.
- Rennie, John, Philip Bruce White, and Elsie J. Harvey. 1921. "Isle of Wight Disease in Hive Bees: The Etiology of the Disease." *Transactions of the Royal Society of Edinburgh*, vol. 52, part 4, no. 29, pp. 737-79.
- Ruzicka, Ferdinand. 2003. "Schäden Durch Elektrosmog." *Bienenwelt* 10: 34-35.
- Ruzicka, Ferdinand. 2006. "Schäden an Bienenvölkern." *Diagnose: Funk* 2006.
- Sharma, Ved Parkash and Neelima R. Kumar. 2010. "Changes in Honeybee Behaviour and Biology under the Influence of Cellphone Radiations." *Current Science* 98(10): 1376-78.
- Svensson, Börje. 2003. "Silent Spring in Northern Europe?" *Bees for Development Journal* 71: 3-4.
- Underwood, Robyn M. and Dennis vanEngelsdorp. 2007. "Colony Collapse Disorder: Have We Seen This Before?" *Bee Culture* 35(7): 13-18.
- vanEngelsdorp, Dennis, Jay D. Evans, Claude Saegerman, Chris Mullin, Eric Haubruge, Bach Kim Nguyen, Maryann Frazier, Jim Frazier, Diana Cox-Foster, Yanping Chen, Robyn Underwood, David R. Tarpy, and Jeffery S. Pettis. 2009. "Colony Collapse Disorder: A Descriptive Study." *PLoS ONE* 4(8): e6481.
- Warnke, Ulrich. 1973. "Neue Ergebnisse der Elektrophysiologie der Bienen. *Apidologie* 4(2): 150.
- Warnke, Ulrich. 1975. "Insekten und Vögel erzeugen elektrische Felder. *Umschau* 75(15): 479.
- Warnke, Ulrich. 1976. "Effects of Electric Charges on Honeybees." *Bee World* 57(2): 50-56.

Warnke, Ulrich. 2009. Bienen, Vögel und Menschen: Die Zerstörung der Natur durch "Elektrosmog." Published in English as Bees, Birds and Mankind: Destroying Nature by "Electrosmog." Kempten, Germany: Kompetenzinitiative.

Westerdahl, B. B. and N. E. Gary. 1981. "Flight, Orientation, and Homing Abilities of Honeybees Following Exposure to 2.45-GHz CW Microwaves. Bioelectromagnetics 2: 71-75.

Wilson, William T. and Diana M. Menapace. 1979. "Disappearing Disease of Honey Bees: A Survey of the United States." American Bee Journal, February, pp. 118-19; March, pp. 184-86, 217.

Respectfully submitted,

Annette P Kastner, CPA
Charlottesville, VA